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The Examiner essentially reiterated the position taken in the previous Office action, namely

- I) that Claims 1 to 4 and 6 to 13 were indefinite under Section 112, 12;
- II) that Claims 1 to 3, 8 to 11 and 13 were anticipated under Section 102(b), or were rendered obvious under Section 103(a), by the teaching of Earle et al. (US 2004/0015009);
- III) that Claims 1 to 3, 8 to 11 and 13 were rendered obvious under Section 103(a) by the teaching of Earle et al. (ibid.) when taken in view of Hackh's Chemical Dictionary and either the disclosure of Kawaki et al. (US 5,543,474) or the disclosure of Thiam et al. (US 4,751,291);
- IV) that Claims 2, 6, 7, 9 and 12 were rendered obvious under Section 103(a) by the combination of references as set forth in (III) when further taken in view of the disclosure of Snyder (Introduction to Modern Liquid Chromatography);
- V) that Claim 4 was rendered obvious under Section 103(a) by the combination of references as set forth in (III) when further taken in view of the disclosure of Gerhold (US 4,402,832); and
- VI) that Claim 11 was rendered obvious under Section 103(a) by the combination of references as set forth in (III) when further taken in view of the disclosure of Wasserscheid (Ionic Liquids in Synthesis).

For the reasons presented in applicants' previous paper²⁾ and in light of the following it is respectfully requested that the respective rejections be withdrawn.

I) Regarding the Examiner's rejection of Claims 1 to 4 and 6 to 13 under Section 112, 12:

The Examiner asserted that the metes and bounds of "high-boiling compounds" could not be determined, and that the claims were, therefore, indefinite.

However, the "distinctly claim" requirement of 35 U.S.C. §112, 12, means that a claim must have a clear and definite meaning when

2) Applicants' paper dated April 27, 2006, which is herewith incorporated by reference.

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construed in the light of the complete patent document.³⁾ The test of definiteness is whether one skilled in the art would understand the bounds of the claim when reading it in the light of the specification,⁴⁾ and the degree of precision which is necessary in the claim is a function of the claimed subject matter.⁵⁾ Breadth alone is not indefiniteness,⁶⁾ and⁷⁾

In rejecting a claim under the second paragraph of 35 U.S.C. 112, it is incumbent on the examiner to establish that one of ordinary skill in the pertinent art, when reading the claims in light of the supporting specification, would not have been able to ascertain with reasonable degree of precision and particularity the particular area set out and circumscribed by the claims.

Applicants claims are drawn to a certain process for the purification of ionic liquids which are contaminated with "a polar, high boiling compound which cannot be removed completely from the ionic liquids by way of a distillation and/or which has a vapor pressure of less than about 10 mbar at room temperature," and the respective terminology is further explained on page 11, indicated lines 14 to 35, of the application. The Examiner has not put forth any reasons which establish that a person of ordinary skill in the art would not be able to ascertain the metes and bounds of the "polar, high boiling compound which cannot be removed completely from the ionic liquids by way of a distillation" or of the "polar, high boiling compound which has a vapor pressure of less than about 10 mbar at room temperature," with a reasonable degree of precision and particularity when reading the claim in light of applicants' supporting description of the invention. The Examiner has, therefore, not met the burden to establish that applicants' Claims 1 to 4 and 6 to 13 are unpatentable under Section 112, 12. Favorable reconsideration of the Examiner's position

3) *Standard Oil Co. v. American Cyanamid Co.*, 774 F.2d 448, 227 USPQ 293 (Fed. Cir. 1985).

4) *Morton Int. Inc. v. Cardinal Chem. Co.*, 5 F.3d 1464, 28 USPQ2d 1190 (Fed. Cir. 1993); *Orthokinetics Inc. v. Safety Travel Chairs, Inc.*, 806 F.2d 1565, 1 USPQ2d 1081 (Fed. Cir. 1986).

5) *Hybritech Inc. v. Monoclonal Antibodies, Inc.*, 802 F.2d 1367, 231 USPQ 81 (Fed. Cir. 1986); *Miles Labs., Inc. v. Shannon, Inc.*, 997 F.2d 870, 27 USPQ2d 1123 (Fed. Cir. 1993).

6) *In re Gardner et al.*, 427 F.2d 786, 166 USPQ 138 (CCPA 1970); *In re Conley et al.*, 490 F.2d 972, 180 USPQ 454 (CCPA 1974); *Ex parte Lewis et al.*, 197 USPQ 543 (POBA 1977); *Ex parte Scherberich et al.*, 201 USPQ 397 (POBA 1977); *Ex parte Schundehutte et al.*, 184 USPQ 697 (POBA 1974); see also Judge Baldwin's concurring opinion in *In re Mayhew*, 927 F.2d 1229, 188 USPQ 356 (CCPA 1976).

7) *Ex parte Wu*, 10 USPQ2d 2031 at 2033 (BPAI 1989).

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and withdrawal of the respective rejection is, therefore, respectfully solicited.

II) Regarding the Examiner's rejection of Claims 1 to 3, 8 to 11 and 13 under Section 102(b), or under Section 103(a), in light of the teaching of Earle et al. (US 2004/0015009):

Anticipation under Section 102 can be found only if a reference shows exactly what is claimed, ie. all material elements of the invention as claimed must be found in one prior art source,⁸⁾ the elements must be shown in the reference in as much detail as is contained in the claim,⁹⁾ and the elements must be shown in the reference in the part-to-part relationship which is set forth in the claim.¹⁰⁾ The teaching of Earle et al. cannot be deemed to provide a description of the subject matter defined in applicants' claims which meets these standards which were developed by the Courts for anticipation under Section 102.

Applicants' invention relates, in accordance with the provisions of Claims 1 and 8, to a process for the purification of ionic liquids which are contaminated with a polar, high boiling compound which cannot be removed completely from the ionic liquids by way of a distillation and/or which has a vapor pressure of less than about 10 mbar at room temperature, and applicants' process comprises providing a mixture comprising the ionic liquids and the said polar, high boiling compound, and removing the polar, high boiling compound from the ionic liquids by adsorptive separation.

The teaching of Earle et al. pertains to a process for the oxidation of alkyl-aromatic compounds which is conducted in the presence of an ionic liquid and an acid promoter as catalyst. With regard to the recovery of the oxidation product, the reference states:¹¹⁾

This invention also allows for the separation of the ionic liquid and product by physical or chemical means such as distillation, steam distillation, azeotropic distillation, sublimation, gravity separation, solvent extraction, crystallization, supercritical fluid extraction and chromatography.

8) Cf. *In re Marshall*, 577 F.2d 301, 198 USPQ 344 (CCPA 1978); *In re Kalm*, 378 F.2d 959, 154 USPQ 10 (CCPA 1967).

9) Cf. *Richardson v. Suzuki Motor Co.*, 868 F.2d 1226, 9 USPQ2d 1913 (Fed. Cir. 1989).

10) Cf. *Lindemann Maschinenfabrik v. American Hoist & Derrick Co.*, 730 F.2d 1452, 221 USPQ 481 (Fed. Cir. 1984).

11) Cf. page 1, para. (0008), of US 2004/0015009.

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and illustrates the recovery of the product by distillation,¹²⁾ and by sublimation.¹³⁾ It should be noted, however, that the reference does not specifically address the recovery of ionic liquids from the reaction mixture. It is merely mentioned¹⁴⁾

The ionic liquid/acidic promoter can be separated from the product by some physical or chemical means such as distillation, steam distillation, azeotropic distillation, sublimation, gravity separation, solvent extraction, crystallization, supercritical fluid extraction and chromatography.

The teaching of Earle et al. is not deemed to address the purification of an ionic liquid which is contaminated with a polar compound as specified in applicants' claims. The the oxidation product obtained in accordance with Earle et al.'s process, the starting materials as well as nitro-substituted by-products which are encountered in accordance with the illustrative examples of the reference cannot be deemed to constitute contaminants since these materials are distilled off. To the extent that such materials are recovered from the reaction mixture these products or by-products cannot reasonably be regarded as contaminants which fall within the realm of the "polar, high boiling compound which cannot be removed completely from the ionic liquids by way of a distillation and/or which has a vapor pressure of less than about 10 mbar at room temperature" referenced in applicants' claims. Moreover, the reference fails to identically describe a procedure in which an ionic liquid which is contaminated by such an impurity is purified by way of an absorptive separation. As such, the reference fails to show applicants' process with the exactness and identity which is required for a finding of anticipation under Section 102. It is therefore respectfully requested that the respective rejection be withdrawn. Favorable action is solicited.

The teaching of Earle et al. is also not deemed to be sufficient to render applicants' invention *prima facie* obvious within the meaning of Section 103(a). As applicants pointed out in their previous paper, three basic criteria have to be met in order to establish a *prima facie* case of obviousness:¹⁵⁾

- (1) There must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one

12) Cf. Examples 1 to 4, paras. [0023] to [0030], of US 2004/0015009.

13) Cf. Example 5, paras. [0031] to [0033], of US 2004/0015009.

14) Cf. para. [0043] of US 2004/0015009.

15) Cf. MPEP §2143.

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of ordinary skill in the art, to modify the reference or to combine the reference teachings,

- (2) there must be a reasonable expectation of success, and
- (3) the prior art reference or the combined references must teach or suggest all of the claim limitations.

Additionally, the teaching or suggestion to make the claimed combination and the reasonable expectation of success must both be found in the prior art and cannot be based on the applicant's disclosure.¹⁶⁾

The information which is provided in the reference concerns, on the one hand, means to separate the product from the reaction mixture and, on the other hand, means by which the combination of the ionic liquid and the acid promoter can be separated from the product. The reference aims at providing the oxidation products and contemplates recycling the ionic liquid/acidic promoter combination. It is, for the purposes of the teaching of Earle et al., without consequence whether the ionic liquid/acidic promoter fraction which remains after the product and other materials have been distilled off comprises residual amounts of the product and/or other materials. In fact, when the ionic liquid/acidic promoter combination is recycled as discussed in the teaching of Earle et al., any residual amounts of the product and/or starting material are, again, made available. Even if any residual amounts of the product and/or other materials remained in the ionic liquid which is recovered after the distillation or sublimation of the product, a person of ordinary skill in the art would, therefore, not have been motivated by the reference to remove any such residues from the ionic liquid. As such, the suggestion or motivation to do what applicants have done is lacking.

Moreover, assuming arguendo that the distillative separation of the oxidation product and the by-products which is illustrated in the teaching of Earle et al. is incomplete, ie. residual amounts of the product and/or by-products remain in the ionic liquid, the reasonable expectation of success is lacking. The Examiner urged that the separation methods which are enumerated by Earle et al. had to be considered as equivalents and that it would have been obvious to employ any one of the other separation methods instead of the distillation procedure which is illustrated in the reference. However, under the proposition that the enumerated separation methods are equivalent a person of ordinary skill in the art cannot reasonably expect to

16) *In re Vaeck*, 947 F.2d 488, 20 USPQ2d 1438, 1442 (Fed. Cir. 1991).

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achieve a different separation success by substituting one of the separation methods for another, equivalent separation method. As such, the reasonable expectation of success is lacking.

It should also be noted that the purification of applicants' invention *inter alia* pertains to the purification of contaminated ionic liquids which contain contaminants that cannot be removed completely from the ionic liquid by way of a distillation. The separation methods which are enumerated by Earle et al. are, accordingly, clearly not equivalent where applicants' invention is concerned. The lack of equivalence of the respective purification methods is not only expressed in applicants' claims but is also further illustrated in applicants' examples on pages 14 and 15 of the application. As shown therein, the adsorptive separation of applicants' process succeeds in removing contaminants which cannot be removed from a contaminated ionic liquid by extraction with non-polar solvents or by distillation.

The foregoing shows that at least two of the basic criteria for establishing a *prima facie* case of obviousness under Section 103(a) are not met where applicants' invention and the teaching of Earle et al. is concerned. It is therefore respectfully requested that the respective rejection be withdrawn. Favorable action is solicited.

III) Regarding the Examiner's rejection of Claims 1 to 3, 8 to 11 and 13 under Section 103(a) in light of the teaching of Earle et al. (*ibid.*) when taken in view of Hack's Chemical Dictionary and either the disclosure of Kawaki et al. (US 5,543,474) or the disclosure of Thiem et al. (US 4,751,291):

The Examiner applied the disclosures of Hack's Chemical Dictionary, of Kawaki et al. and of Thiem et al. to show that certain by-products which are encountered in the illustrative examples of Earle et al. are high boiling as well as polar. However, whether or not these compounds are within the realm of the "polar, high boiling compound which cannot be removed completely from the ionic liquid by way of a distillation and/or said compound has a vapor pressure of less than about 10 mbar at room temperature," is not deemed to be of consequence in the determination of obviousness of applicants' invention. As noted in the foregoing, those products and materials cannot be deemed to constitute contaminants to the extent that they are removed in Earle et al.'s procedure by distillation. If residual

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amounts remained in the ionic liquid which is recovered after the distillation according to the procedure addressed in the teaching of Earle et al., the presence of such residual amounts of starting materials or oxidation product in the used ionic liquid is of no consequence when the ionic liquid/acid promoter is recycled. Assuming that certain residual amounts of the oxidation product, the starting materials and/or the by-products remain in the ionic liquid, the primary reference contains nothing which would suggest or imply that the respective amounts can be, or even need to be, removed from the ionic liquid.

Neither one of the secondary references can therefore be considered to add the necessary suggestion or motivation to do what applicants have done. Even when the teaching of Earle et al. is taken in view of the referenced disclosures a person of ordinary skill in the art would not have been motivated to further purify the ionic liquids from the residual polar, high boiling compounds because such compounds are, in the procedure of Earle et al., valuable constituents of the recycled stream. Moreover, the nitro-compounds which are encountered in the illustrative examples of the primary reference are by-products whereas the separation methods which are enumerated by Earle et al. concern the separation of the product and of the ionic liquid or ionic liquid/acid promoter. The disclosures of the secondary references can, in light of the foregoing also not be deemed to contribute to a reasonable expectation of success since neither one of the secondary references nor the teaching of Earle et al. is reasonably concerned with the purifying an ionic liquid from the specific contaminating impurities which are referenced in applicants' claims.

It is therefore respectfully requested that the rejection of Claims 1 to 3, 8 to 11 and 13 under Section 103(a) based on the teaching of Earle et al. and the disclosures of Hack's Chemical Dictionary, of Kawaki et al. and/or of Thiem et al. be withdrawn. Favorable action is solicited.

IV) Regarding the Examiner's rejection of Claims 2, 6, 7, 9 and 12 under under Section 103(a) in light of the combination of references as set forth in (III) when further taken in view of the disclosure of

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Snyder (Introduction to Modern Liquid Chromatography):

The Examiner applied the disclosure of Snyder for stating that ion exchange was the first of various liquid chromatography methods to be used widely under modern conditions, and the Examiner argued that a person of ordinary skill in the art would therefore have been motivated to employ ion exchange in the separation conducted in the procedure of Earle et al. The fact that ion exchange was the first of various liquid chromatography methods to be used widely under modern conditions is, however, not deemed to further motivate a person of ordinary skill in the art to modify the procedure of Earle et al. in such a manner that it entails the purification of a contaminated ionic liquid in the manner defined in applicants' claims. As emphasized in the foregoing, the separations of Earle et al. are directed to a purification of the oxidation product and to a recovery of the ionic liquid/ acid promoter combination and not, as required in accordance with applicants' invention, to a purification of the ionic liquid from impurities which can, for example, not be removed completely by way of distillation. Even when the teaching of Earle et al. is taken in view of the referenced disclosures including the statements found in Snyder, a person of ordinary skill in the art would not have been motivated to purify the ionic liquids from any residual polar, high boiling compounds because such compounds are, in the procedure of Earle et al., valuable constituents of the recycled stream. The statements of Snyder can also not be deemed to contribute to a reasonable expectation of success since the respective reference is not reasonably concerned with the purification of an ionic liquid from the specific contaminating impurities which are referenced in applicants' claims. The mere fact that ion exchange was the first of various liquid chromatography methods to be used widely under modern conditions is not deemed to be sufficient to point a person of ordinary skill in the art away from the teaching of Earle et al. and into the direction of applicants' invention. The teaching or suggestion to make the claimed combination and the reasonable expectation of success must both be found in the prior art and cannot be based on the applicant's disclosure.¹⁷⁾ Here, however, neither the necessary suggestion nor the necessary expectation of success can be derived from the prior art relied upon by the Examiner.

¹⁷⁾ Ibid.

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It is therefore respectfully requested that the rejection of Claims 2, 6, 7, 9 and 12 under Section 103(a) based on the respective references be withdrawn. Favorable action is solicited.

V) Regarding the Examiner's rejection of Claim 4 under Section 103(a) in light of the combination of references as set forth in (III) when further taken in view of the disclosure of Gerhold (US 4,402,832):

The Examiner applied the disclosure of Gerhold for stating that a simulated moving bed is a very successful process for separating components from a feed mixture, and asserted that a person of ordinary skill in the art would have, therefore, been motivated to employ a continuous chromatographic process as required in accordance with applicants' Claim 4 for the separations mentioned in the teaching of Earle et al.

The separations which are addressed in the primary reference are, however, not aimed at purifying an ionic liquid which is contaminated with impurities of a polar, high boiling compound which cannot be removed completely from the ionic liquids by way of a distillation and/or which has a vapor pressure of less than about 10 mbar at room temperature as is required in accordance with applicants' Claim 4. Where the process of Earle et al. is concerned it is of no consequence if residual amounts of starting material and/or oxidation product are retained in the ionic liquid since the primary reference contemplates recycling of the ionic liquid/acid promoter combination. The disclosure of Gerhold would therefore not have motivated a person of ordinary skill in the art to modify Earle et al.'s separations such that the ionic liquid is purified from the contaminants which are specified in applicants' claim. It should also be noted that the separation method which is addressed in the Gerhold reference is, essentially a chromatographic type separation, ie. a type of separation methods which is mentioned by Earle et al. and which the Examiner deems to be equivalent to the distillations which are illustrated in the primary reference. Accordingly, as discussed in item (II) of this paper, a person of ordinary skill in the art cannot reasonably expect to achieve a different separation success when the distillation which is illustrated by Earle et al. is substituted by the simulated moving bed separation. Also, Gerhold points out:¹⁸⁾

18) Cf. col. 5, indicated lines 55 to 60, of US 4,402,832.

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At the onset it is desirous to point out that it is contemplated that the present invention would be efficacious regardless of the separating means employed. The only general limitations are that the flow streams are fluid and that in fact a separation is accomplished by the separating unit in question.

Accordingly, and since the respective reference is not reasonably concerned with the purification of an ionic liquid from the specific contaminating impurities which are referenced in applicants' claims, the disclosure of Gerhold can not be deemed to contribute to a reasonable expectation of success. It is therefore respectfully requested that the respective rejection of Claim 4 under Section 103(a) be withdrawn. Favorable action is solicited.

VI) Regarding the Examiner's rejection of Claim 11 under Section 103(a) in light of the combination of references as set forth in (III) when further taken in view of the disclosure of Wasserscheid (Ionic Liquids in Synthesis):

The Examiner applied the disclosure of Wasserscheid solely for stating that any volatile compound can, in principle, be separated from an ionic liquid by distillation, and argued that a person of ordinary skill in the art would have, therefore, been motivated to remove low boiling compounds by evaporation as required in accordance with applicants' Claim 11 for the separations mentioned in the teaching of Earle et al. Claim 11 depends upon Claim 1 and incorporates the requisite elements by reference. Where those elements are concerned the arguments made in subsection (III) of this paper remain fully applicable. Moreover, the removal of volatile compounds by distillation cannot be deemed to close or even narrow the gap between the subject matter of Claim 1 and the teaching of Earle et al. and the secondary references which were applied by the Examiner in the respective rejection. It is therefore respectfully requested that the rejection of Claim 11 under Section 103(a) based on the combination of references as set forth in (III) and further in view of the disclosure of Wasserscheid be withdrawn. Favorable action is solicited.

In light of the foregoing remarks it is respectfully urged that Claims 1 to 4 and 6 to 13 are patentable under the provisions of Sections 102, 103 and 112, 12. New Claims 14 to 17 depend upon Claims 1 and 8, respectively, so that applicants' remarks in subsections (I)

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to (III) of this paper are fully applicable were the subject matter of those additional claims is concerned. New Claims 18 to 20 correspond, for example, to Claims 1, 14 and 15. Accordingly, applicants' remarks in subsections (I) to (III) of this paper are also fully applicable were the subject matter of these additional claims is concerned. Additionally, these additional claims specify that the contaminated ionic liquid be provided

(a) by separating volatile components from a mixture comprising the ionic liquid, said volatile components and the impurities, by means of evaporation or rectification,

and/or

(b) by separating non-polar components from a mixture comprising the ionic liquid, said non-polar components and the impurities, by means of extraction with a non-polar organic solvent,

before the purification is conducted. The respective measure(s) further distinguish applicants' purification process from the procedures addressed in the *Earle et al.* reference, and the subject matter of Claims 18 to 20 is, therefore, also deemed to be patentable under the provisions of Sections 102, 103 and 112, 12. Favorable action is respectfully solicited.

Please charge any shortage in fees due in connection with the filing of this paper, including Extension of Time fees, to Deposit Account No. 14.1437. Please credit any excess fees to such deposit account.

Respectfully submitted,

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Encl.: CLAIM AMENDMENTS (Appendix I)

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